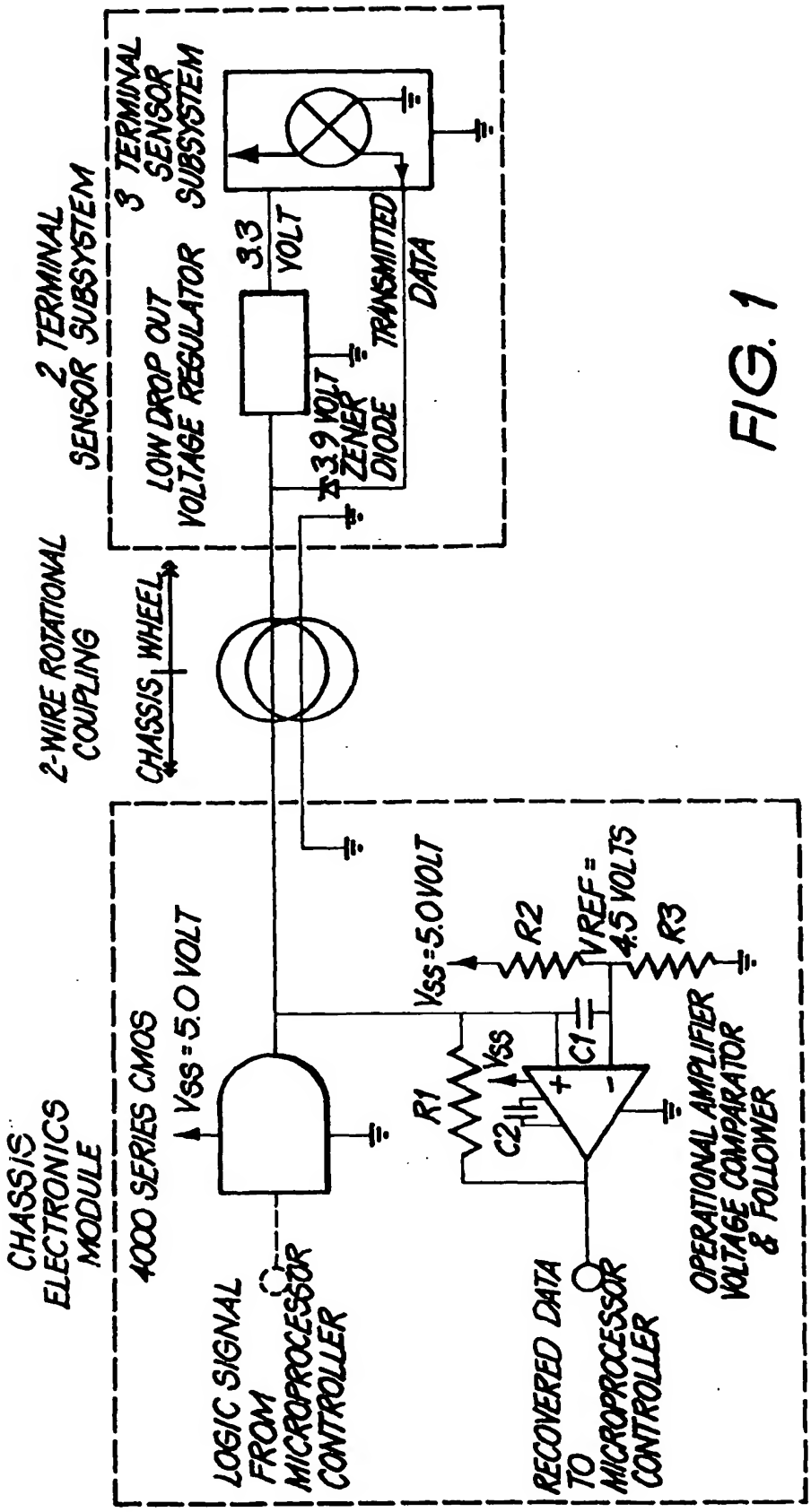

2 TERMINAL SENSOR SUBSYSTEM
3 TERMINAL SENSOR SUBSYSTEM
LOW DROP OUT VOLTAGE REGULATOR
3.3 VOLT
3.9 VOLT ZENER DIODE
TRANSMITTED DATA
2-WIRE ROTATIONAL COUPLING
CHASSIS WHEEL
CHASSIS ELECTRONICS MODULE
4000 SERIES CMOS
Vss = 5.0 VOLT
Vss=5.0 VOLT
R2
VREF = 4.5 VOLTS
R3
R1
C2
C1
Vss
OPERATIONAL AMPLIFIER VOLTAGE COMPARATOR & FOLLOWER
LOGIC SIGNAL FROM MICROPROCESSOR CONTROLLER
RECOVERED DATA TO MICROPROCESSOR CONTROLLER

FIG. 1

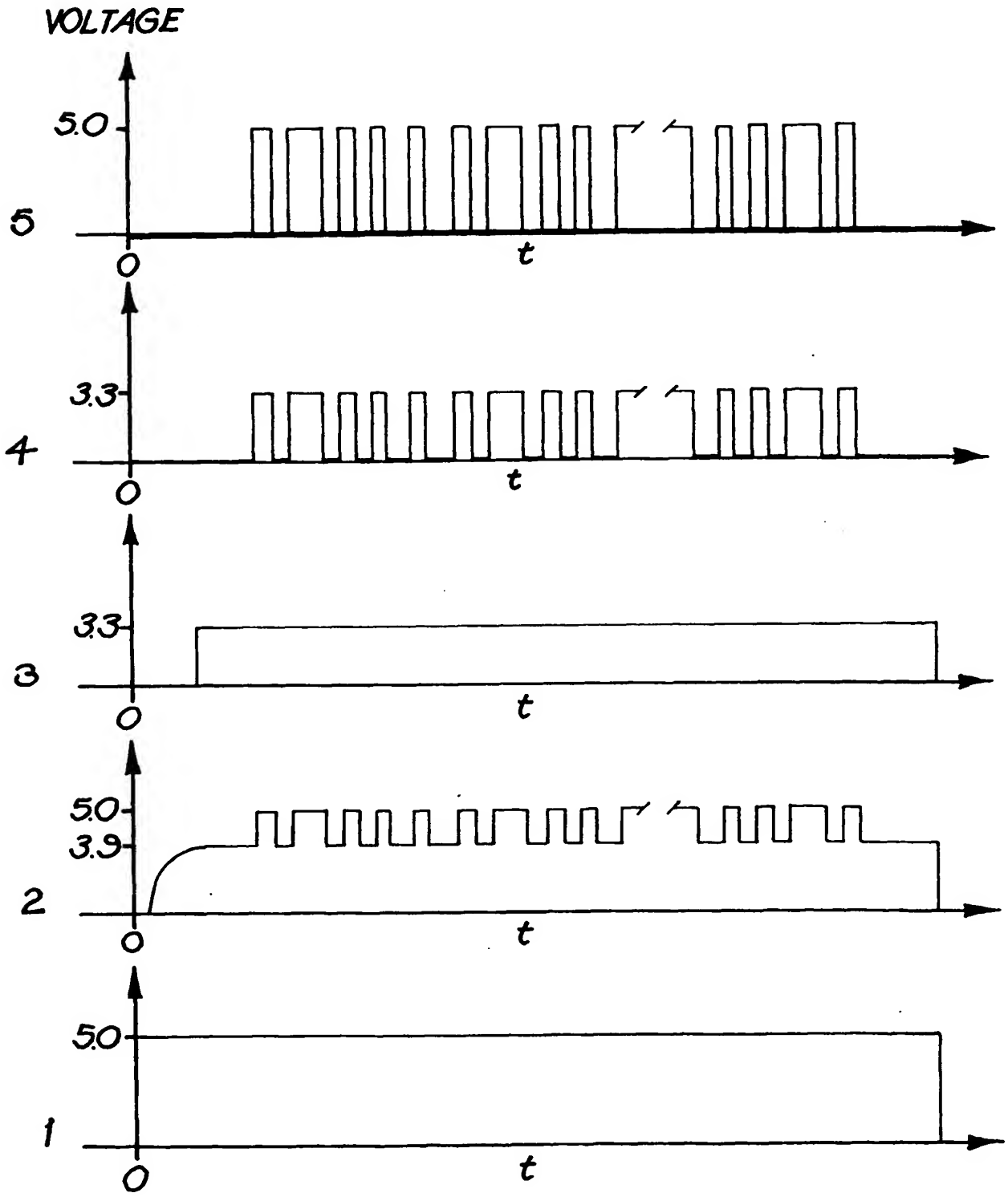


FIG. 2

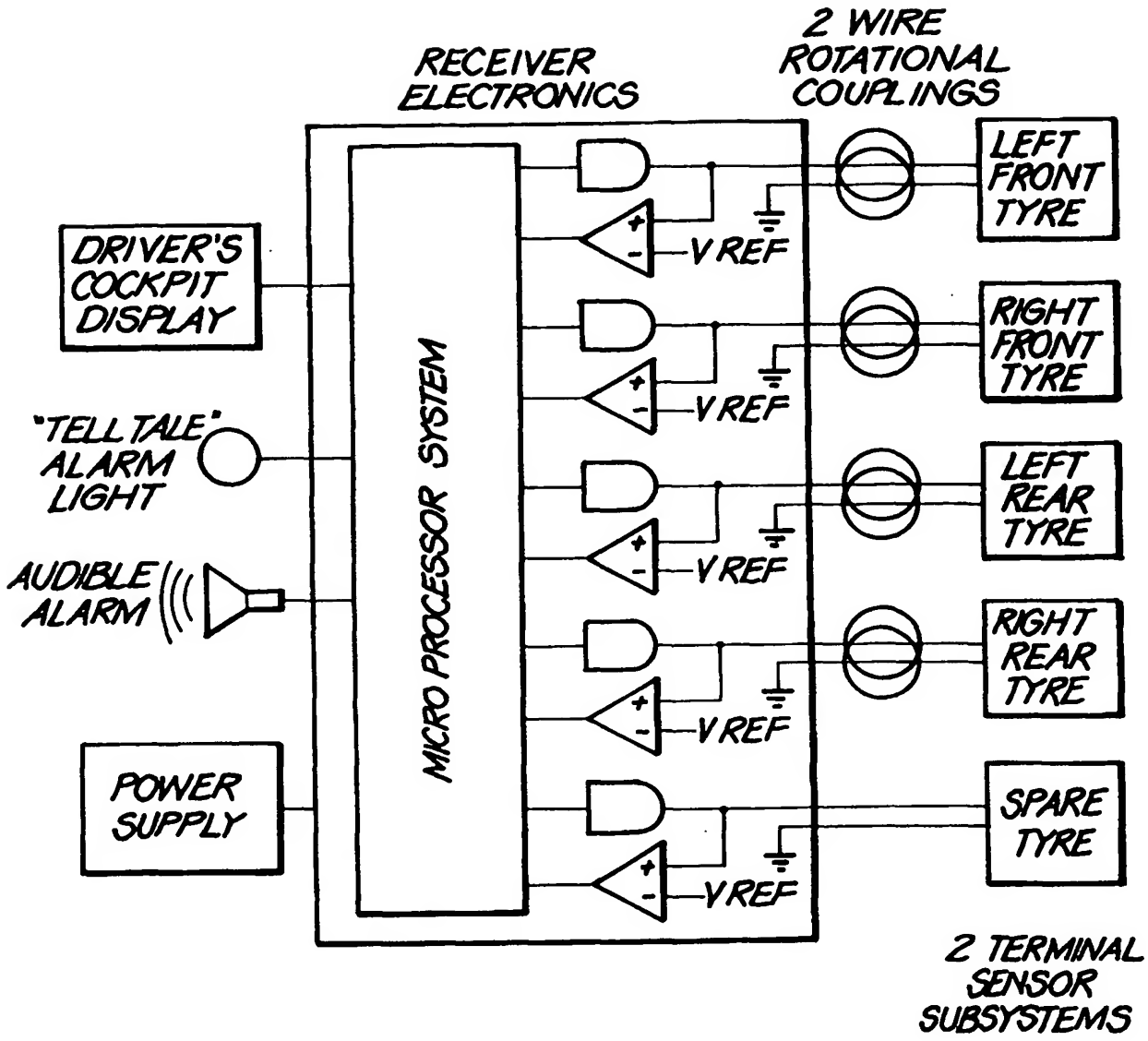
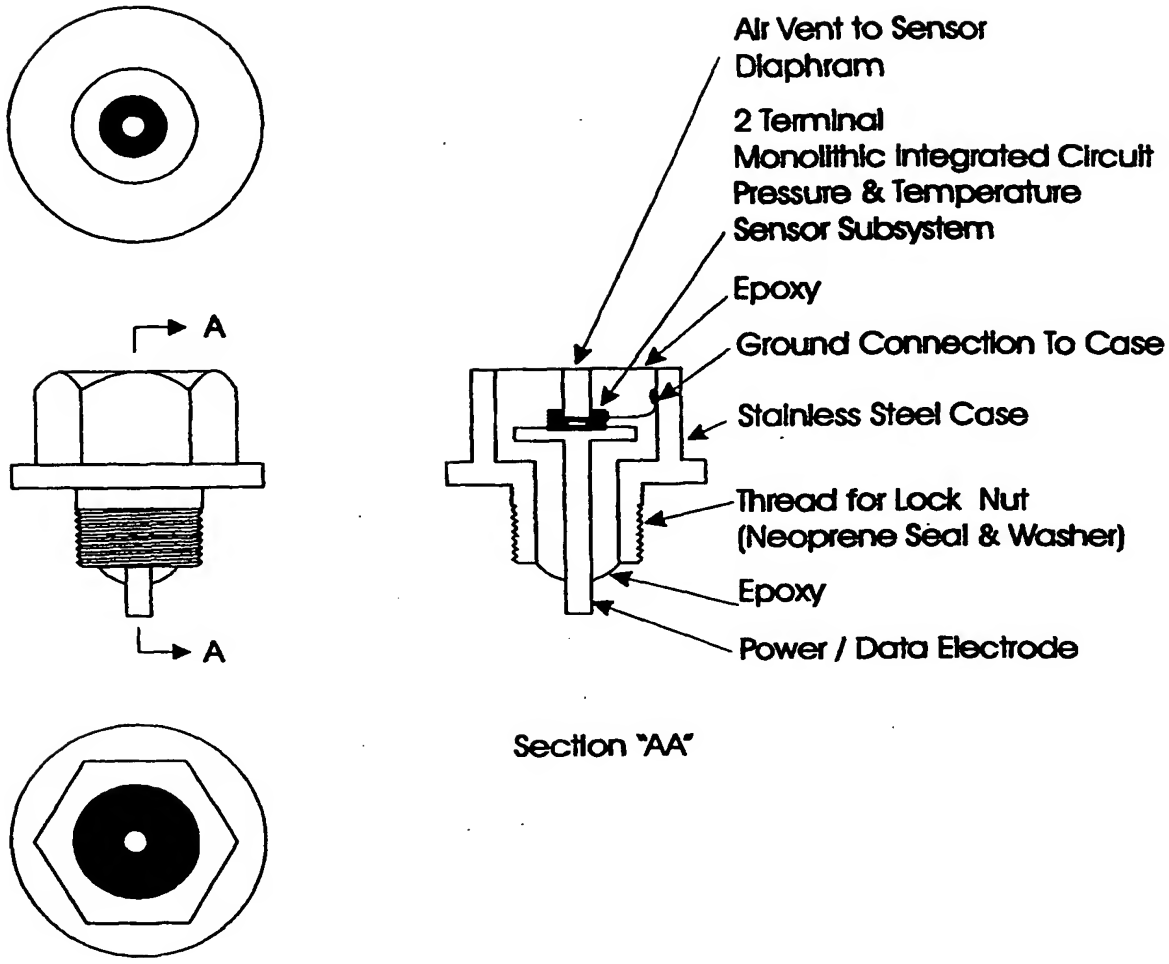

RECEIVER ELECTRONICS
2 WIRE ROTATIONAL COUPLINGS
DRIVER'S COCKPIT DISPLAY
"TELL TALE" ALARM LIGHT
AUDIBLE ALARM
POWER SUPPLY
MICRO PROCESSOR SYSTEM
VREF
VREF
VREF
VREF
VREF
LEFT FRONT TYRE
RIGHT FRONT TYRE
LEFT REAR TYRE
RIGHT REAR TYRE
SPARE TYRE
2 TERMINAL SENSOR SUBSYSTEMS

FIG. 3



2 Terminal Sensor Packaging

Fig. 4

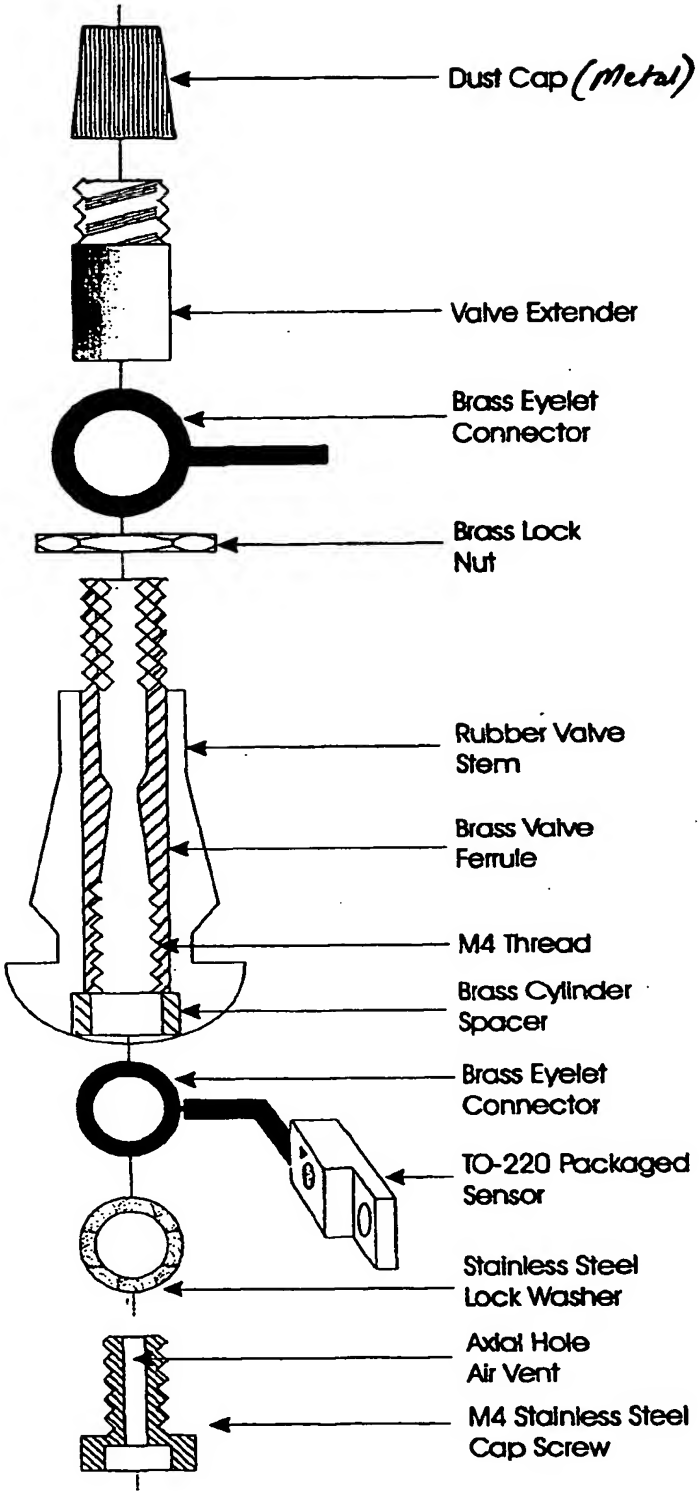
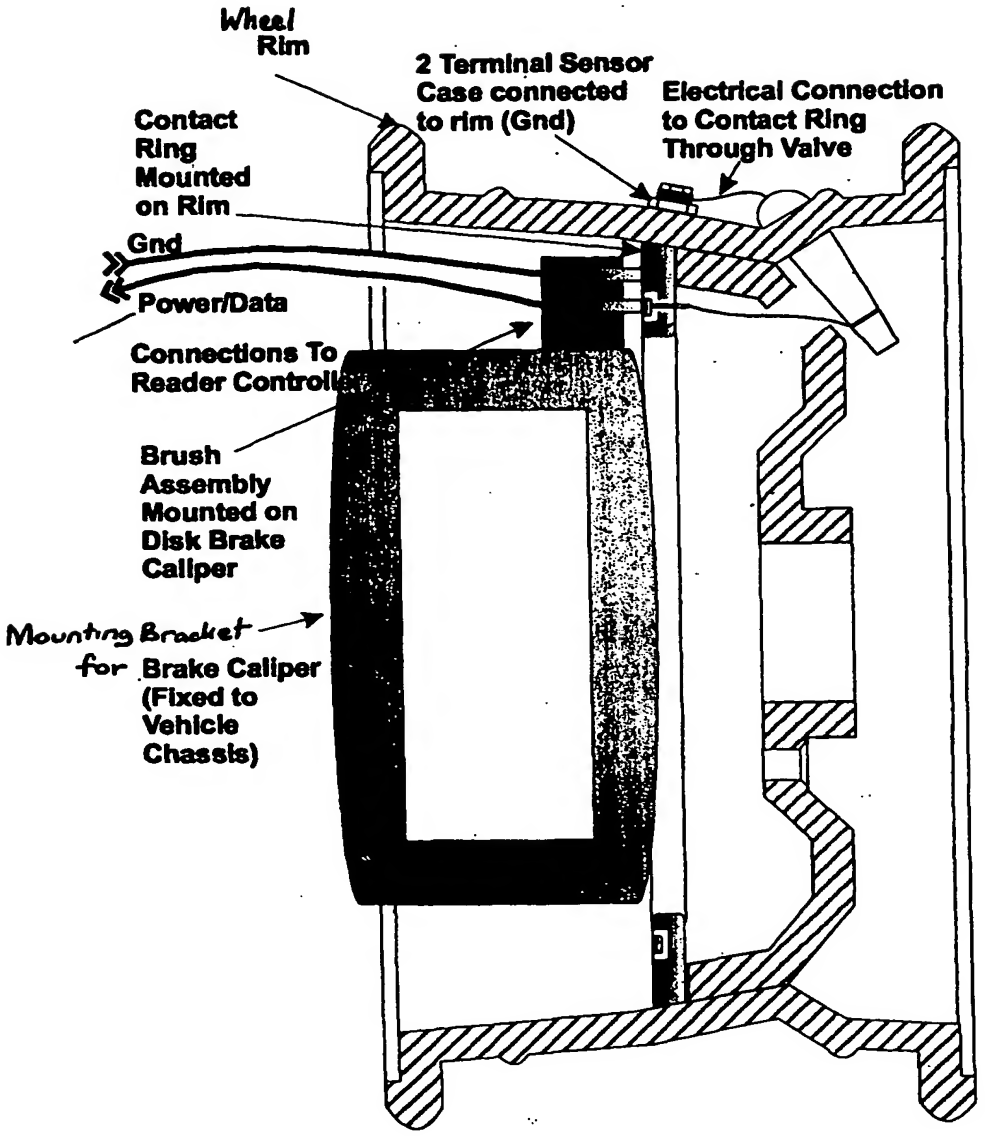


Fig. 5 Tyre Valve Insulated Electrode Used To Connect Sensor To External Face Of Wheel Rim

Fig. 6



System Implementation showing TPMS Enabled Wheel Rim and TPMS Enabled Disk Brake Caliper

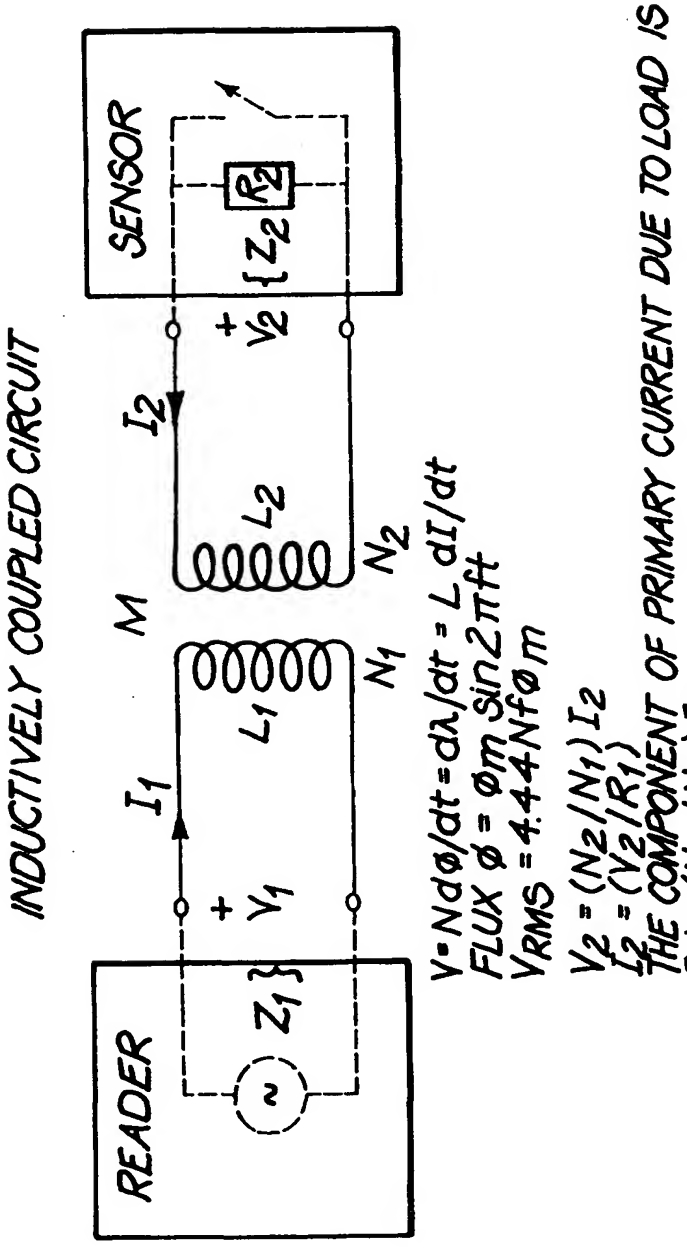
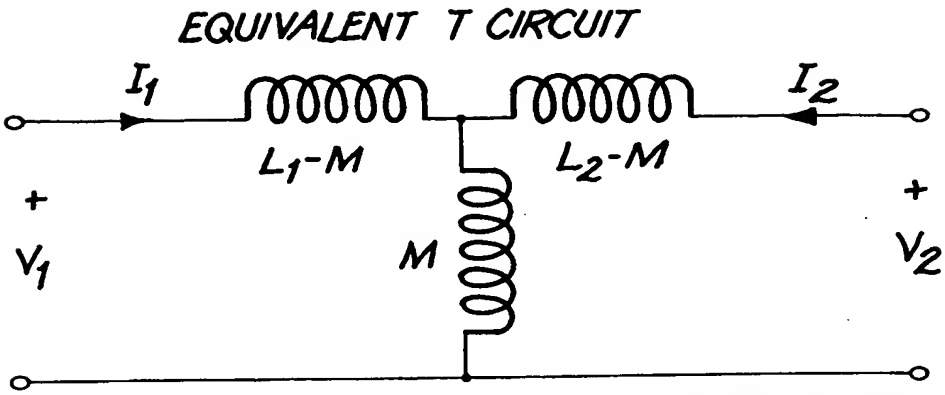

INDUCTIVELY COUPLED CIRCUIT
READER
SENSOR
Z_1
Z_2
R_2
V_1
V_2
I_1
I_2
L_1
L_2
M
N_1
N_2
$V = N d\phi/dt = d\lambda/dt = L\, dI/dt$
FLUX $\phi = \phi_m \sin 2\pi ft$
$V_{RMS} = 4.44 N f \phi_m$
$V_2 = (N_2/N_1) I_2$
$I_2 = (V_2/R_1)$
THE COMPONENT OF PRIMARY CURRENT DUE TO LOAD IS
$I_1' = (N_2/N_1) I_2$

FIG. 7



FOR SINUSOIDS, VOLTAGE V_{12} COUPLED INTO THE INPUT BY A CURRENT I_2 IS $V_{12} = j\omega M_{12} I_2$

WHERE $Z_{12} = j\omega M_{12}$ = MUTUAL IMPEDANCE

IF $Z_{12} = Z_{21}$ OR $M_{12} = M_{21} = M$ USING RECIPROCITY FOR A BILATERAL NETWORK,

THEN $V_1 = j\omega L_1 I_1 + j\omega M I_2 = Z_{11} I_1 + Z_{12} I_2$

AND $V_2 = j\omega M I_1 + j\omega L_2 I_2 = Z_{21} I_1 + Z_{22} I_2$

FIG. 8

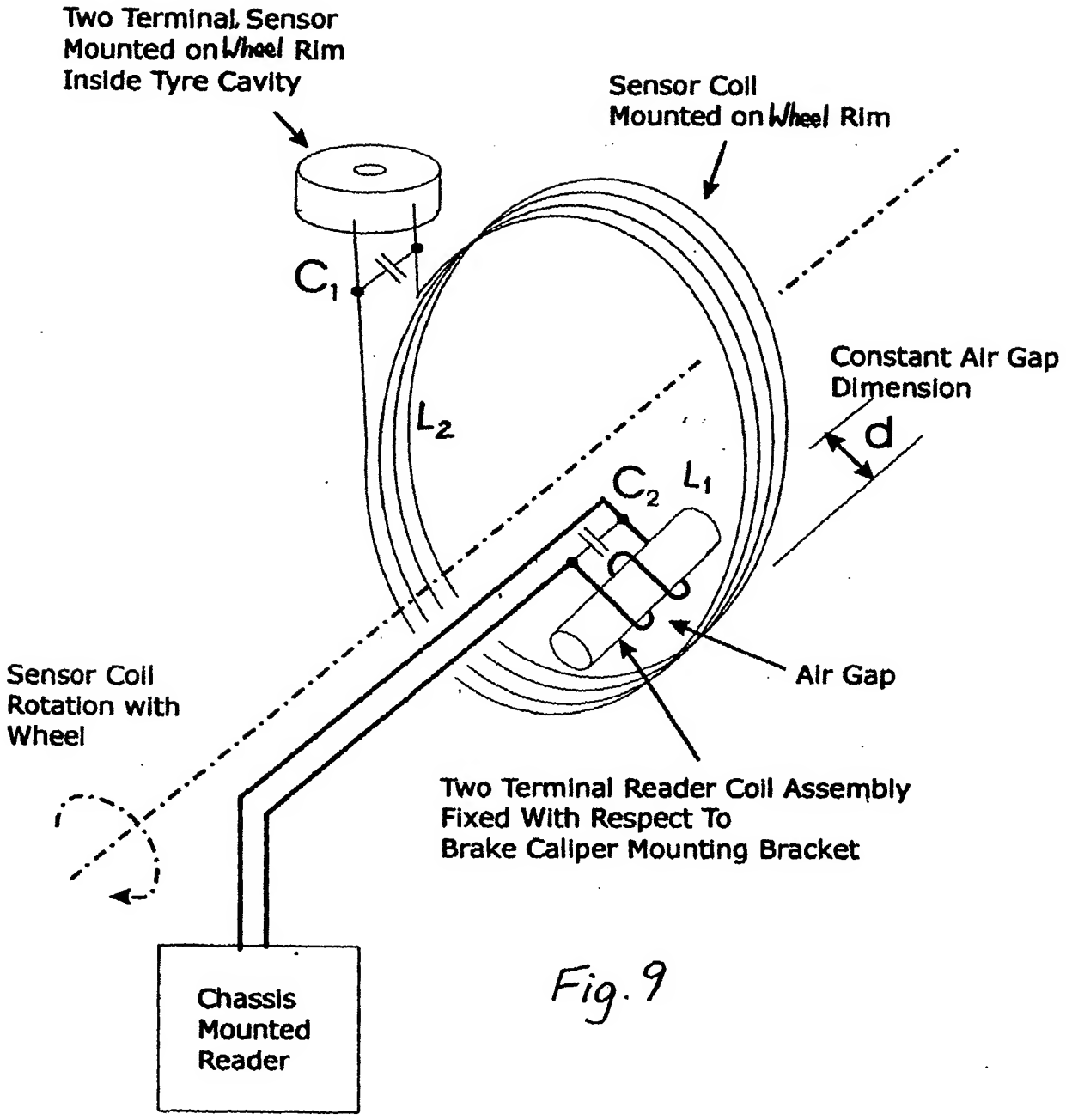
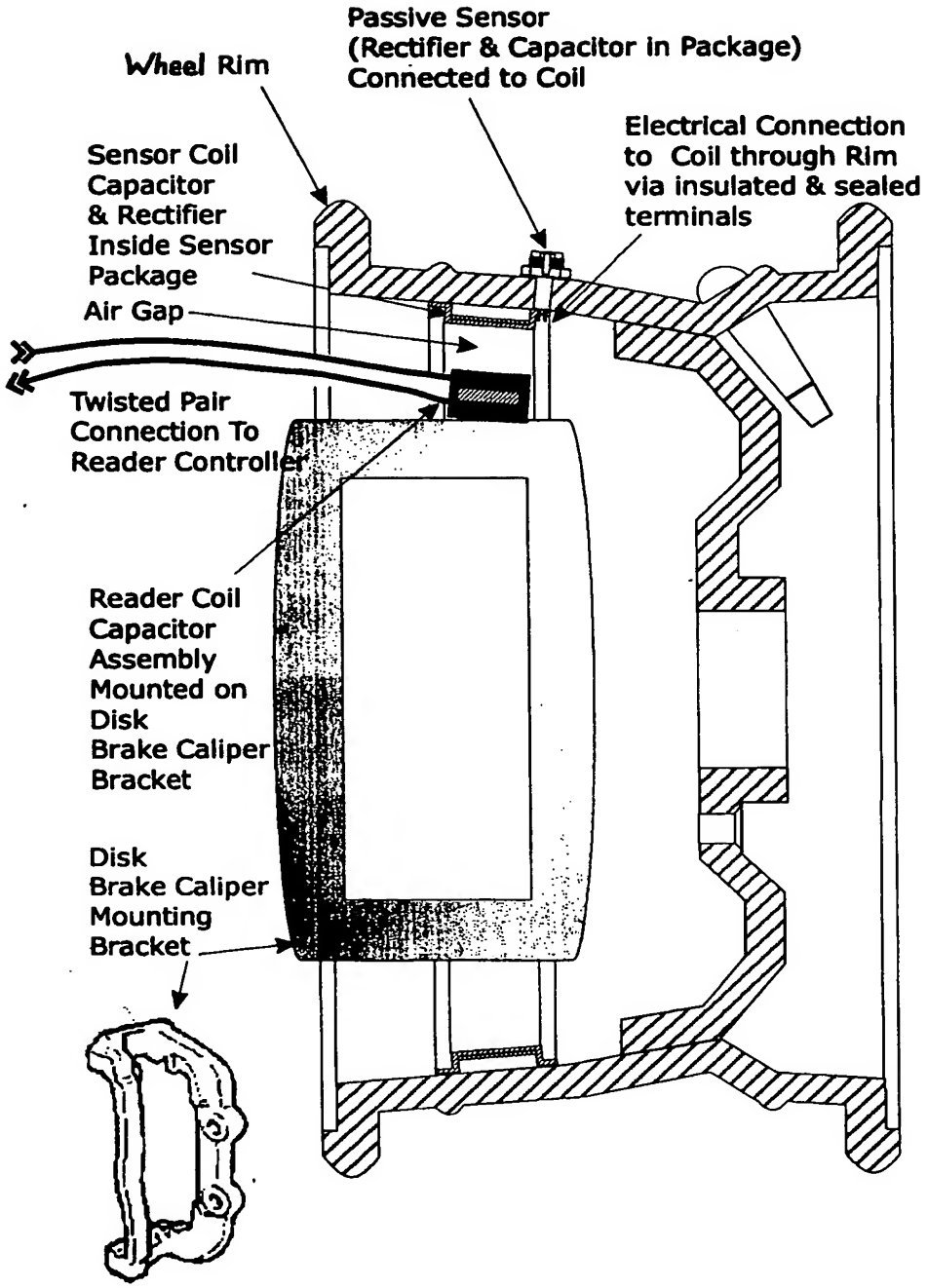
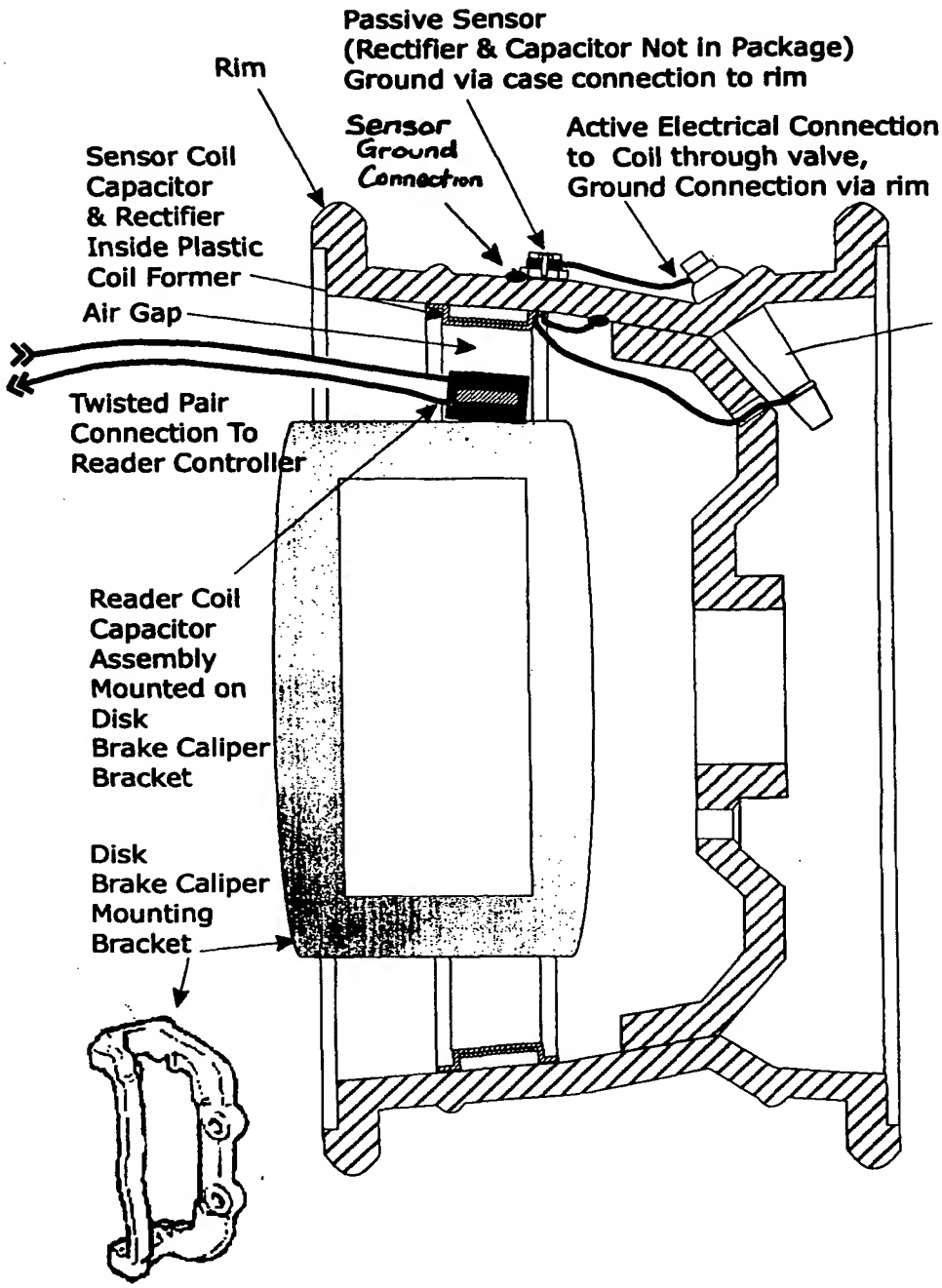

Two Terminal Sensor
Mounted on Wheel Rim
Inside Tyre Cavity
Sensor Coil
Mounted on Wheel Rim
C_1
L_2
Constant Air Gap
Dimension
d
C_2
L_1
Air Gap
Sensor Coil
Rotation with
Wheel
Two Terminal Reader Coil Assembly
Fixed With Respect To
Brake Caliper Mounting Bracket
Chassis
Mounted
Reader

Fig. 9



Non Contact System Showing
TPMS Enabled Steel Wheel Rim and
TPMS Enabled Disk Brake Caliper
Mounting Bracket

Fig. 10



Non Contact System Showing TPMS Enabled Steel Wheel Rim and TPMS Enabled Disk Brake Caliper Mounting Bracket

Fig. 11

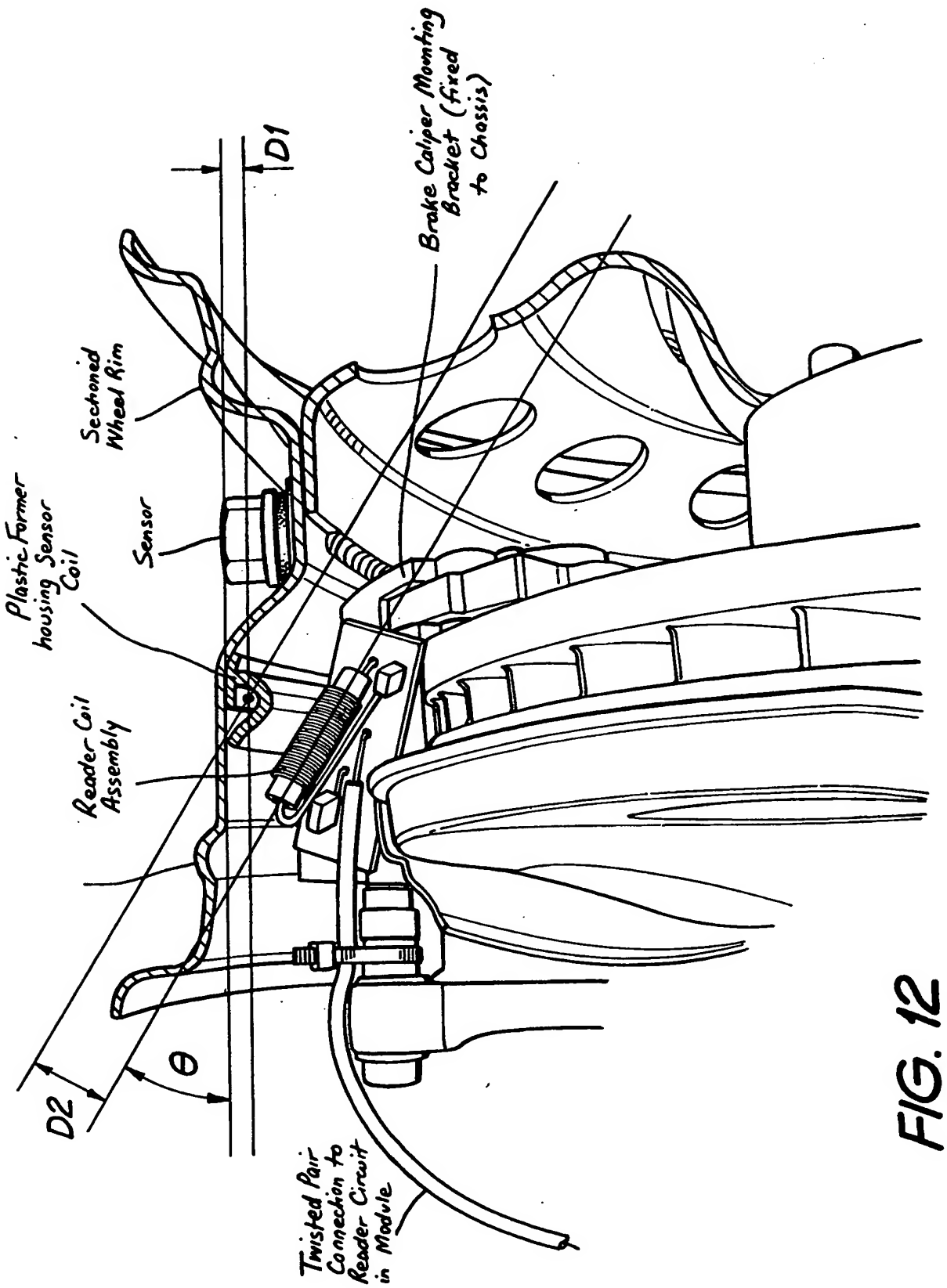

Brake Caliper Mounting Bracket (Fixed to Chassis)
D1
Sectioned Wheel Rim
Sensor
Plastic Former housing Sensor Coil
Reader Coil Assembly
D2
θ
Twisted Pair Connection to Reader Circuit in Module

FIG. 12

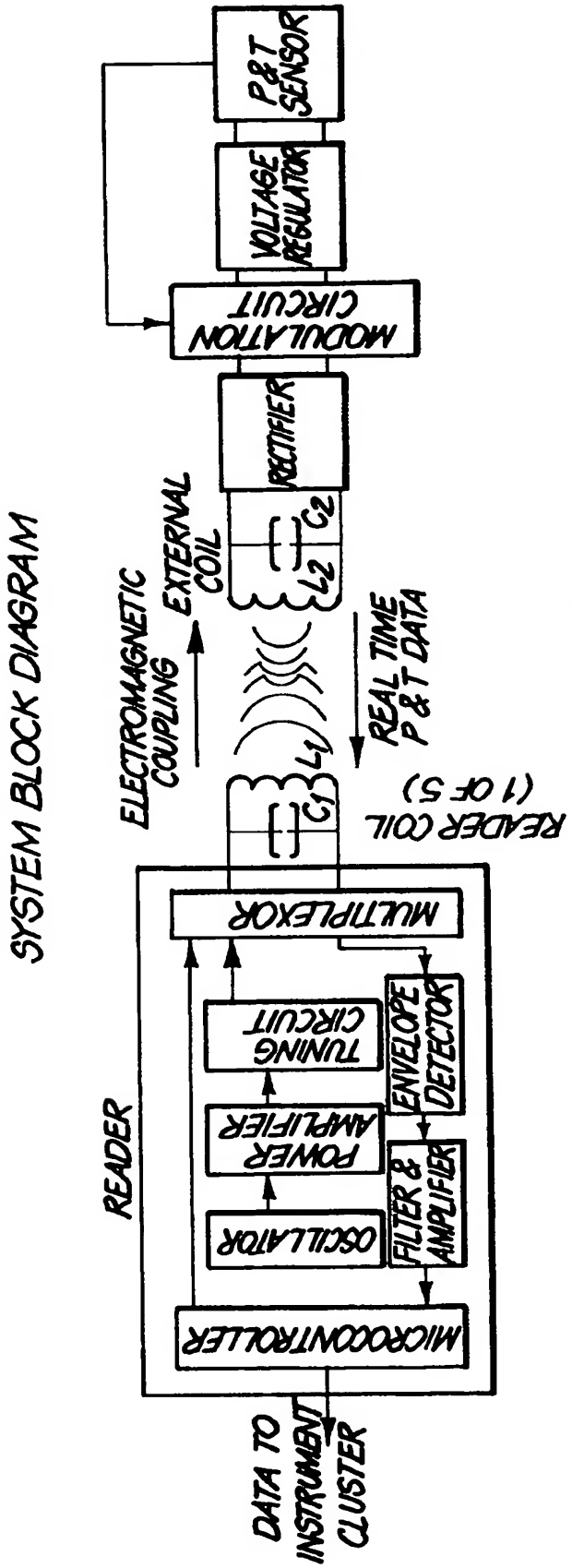

SYSTEM BLOCK DIAGRAM
READER
MICROCONTROLLER
FILTER & AMPLIFIER
ENVELOPE DETECTOR
OSCILLATOR
POWER AMPLIFIER
TUNING CIRCUIT
MULTIPLEXOR
READER COIL (1 OF 5)
C1
L1
ELECTROMAGNETIC COUPLING
EXTERNAL COIL
L2
C2
REAL TIME P & T DATA
RECTIFIER
MODULATION CIRCUIT
VOLTAGE REGULATOR
P & T SENSOR
DATA TO INSTRUMENT CLUSTER

FIG. 13

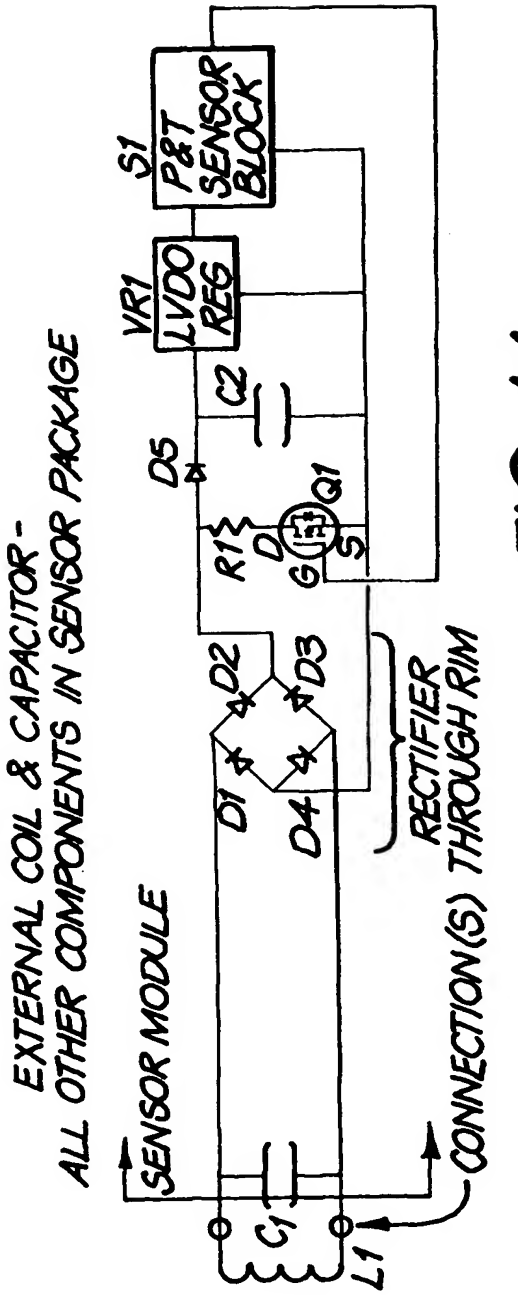

EXTERNAL COIL & CAPACITOR -
ALL OTHER COMPONENTS IN SENSOR PACKAGE
SENSOR MODULE
C1
L1
D1
D2
D3
D4
RECTIFIER
CONNECTION(S) THROUGH RIM
D5
R1
Q1
D
G
S
C2
VR1
LVDO REG
S1
P&T SENSOR BLOCK

FIG. 14

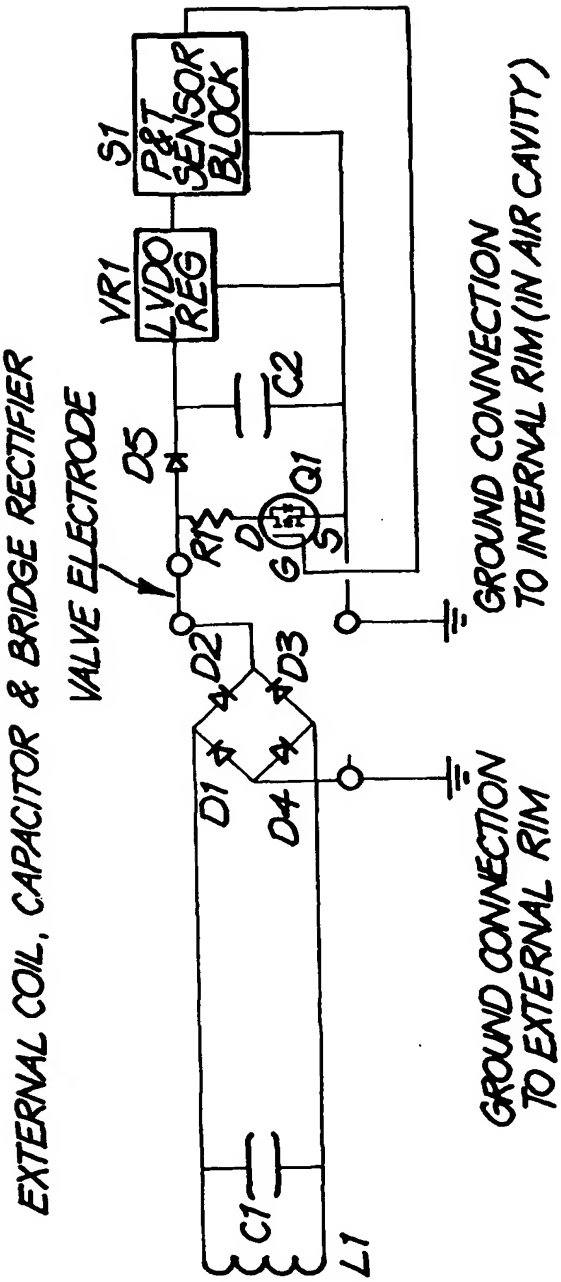

EXTERNAL COIL, CAPACITOR & BRIDGE RECTIFIER
VALVE ELECTRODE
C1
L1
D1
D2
D3
D4
D5
R1
Q1
D
G
S
C2
VR1
LVDO REG
S1
P&T SENSOR BLOCK
GROUND CONNECTION TO EXTERNAL RIM
GROUND CONNECTION TO INTERNAL RIM (IN AIR CAVITY)

FIG. 15

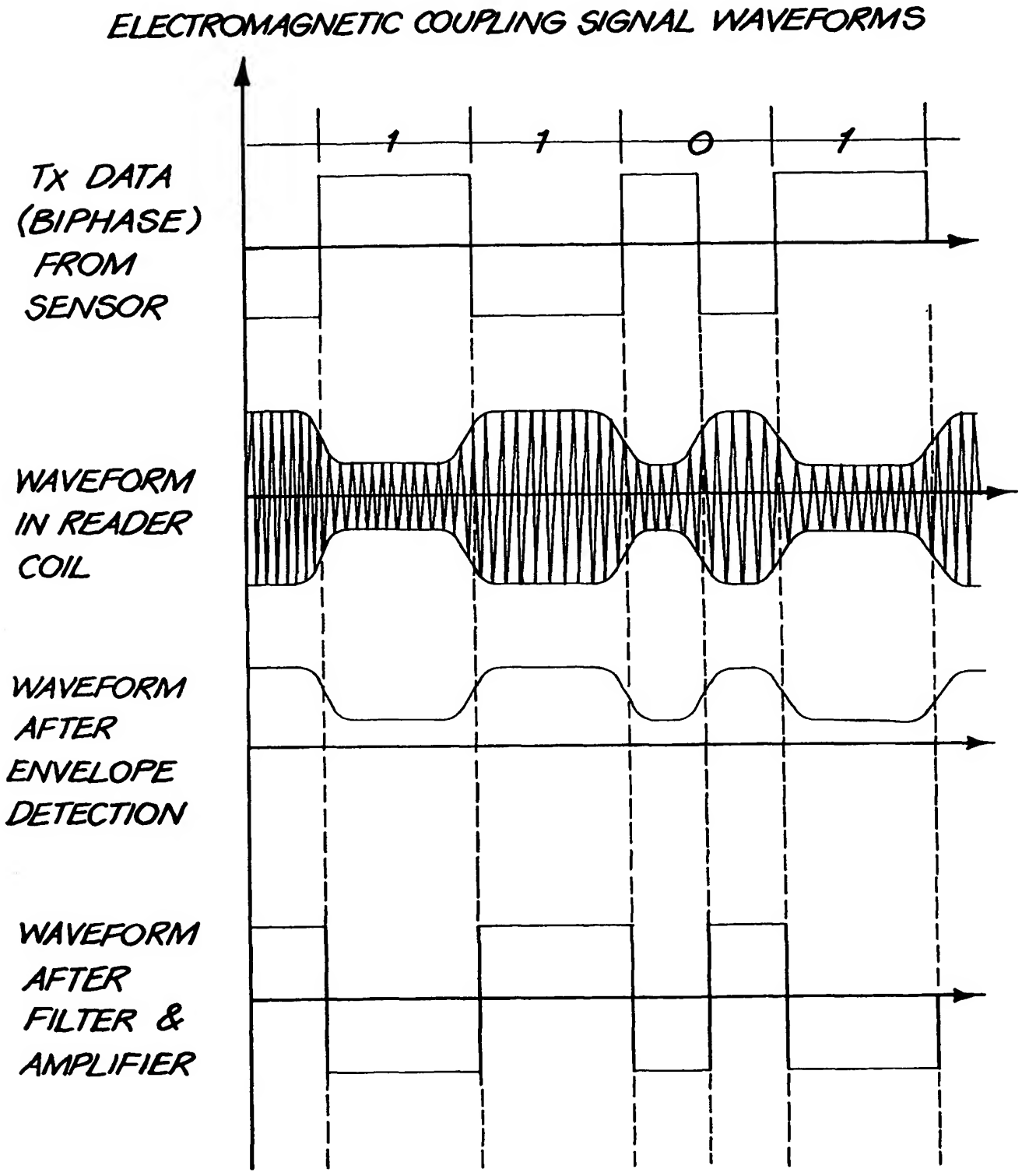

ELECTROMAGNETIC COUPLING SIGNAL WAVEFORMS
1
1
0
1
TX DATA (BIPHASE) FROM SENSOR
WAVEFORM IN READER COIL
WAVEFORM AFTER ENVELOPE DETECTION
WAVEFORM AFTER FILTER & AMPLIFIER

FIG. 16

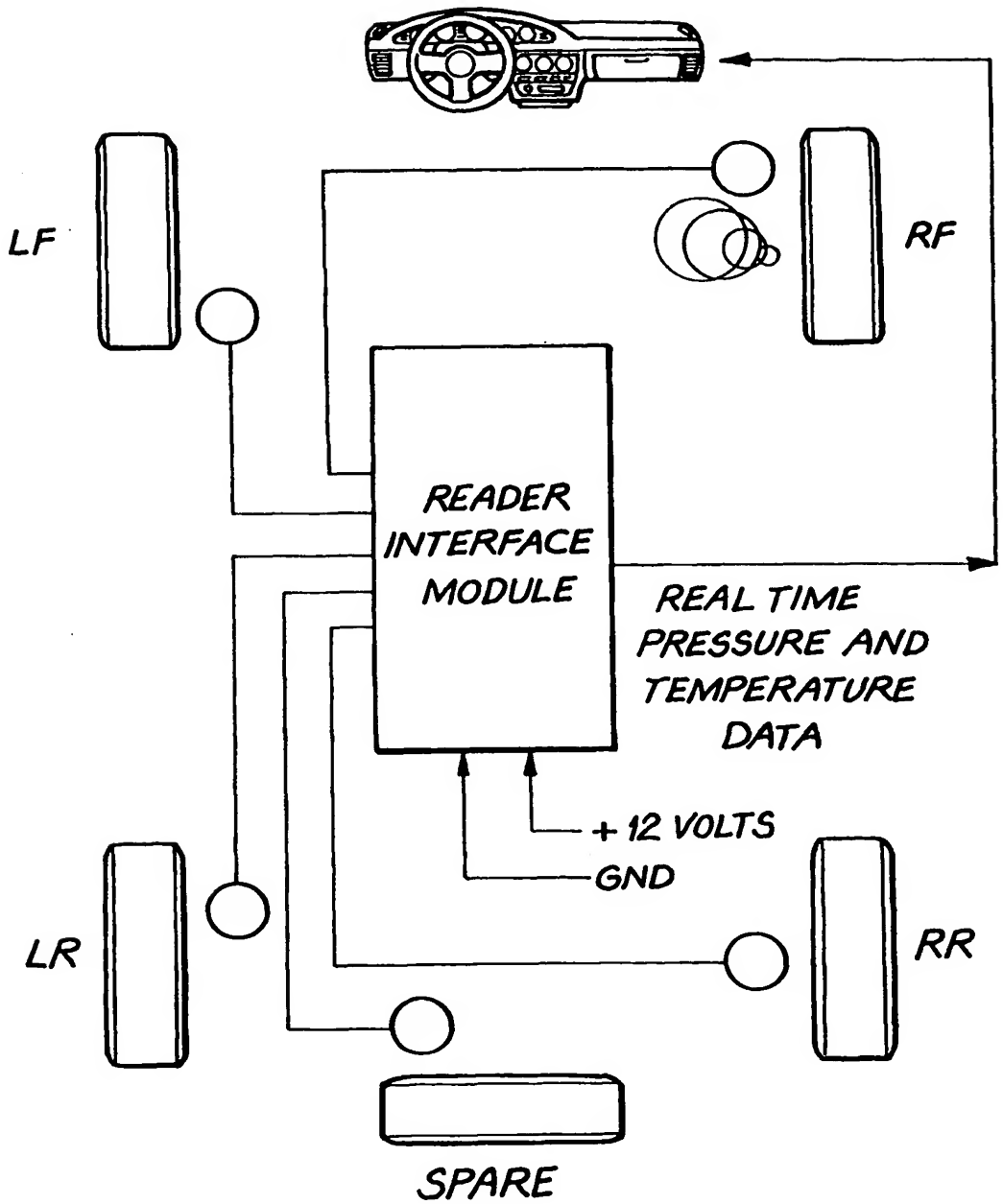

LF
RF
READER INTERFACE MODULE
REAL TIME PRESSURE AND TEMPERATURE DATA
+ 12 VOLTS
GND
LR
RR
SPARE

FIG. 17

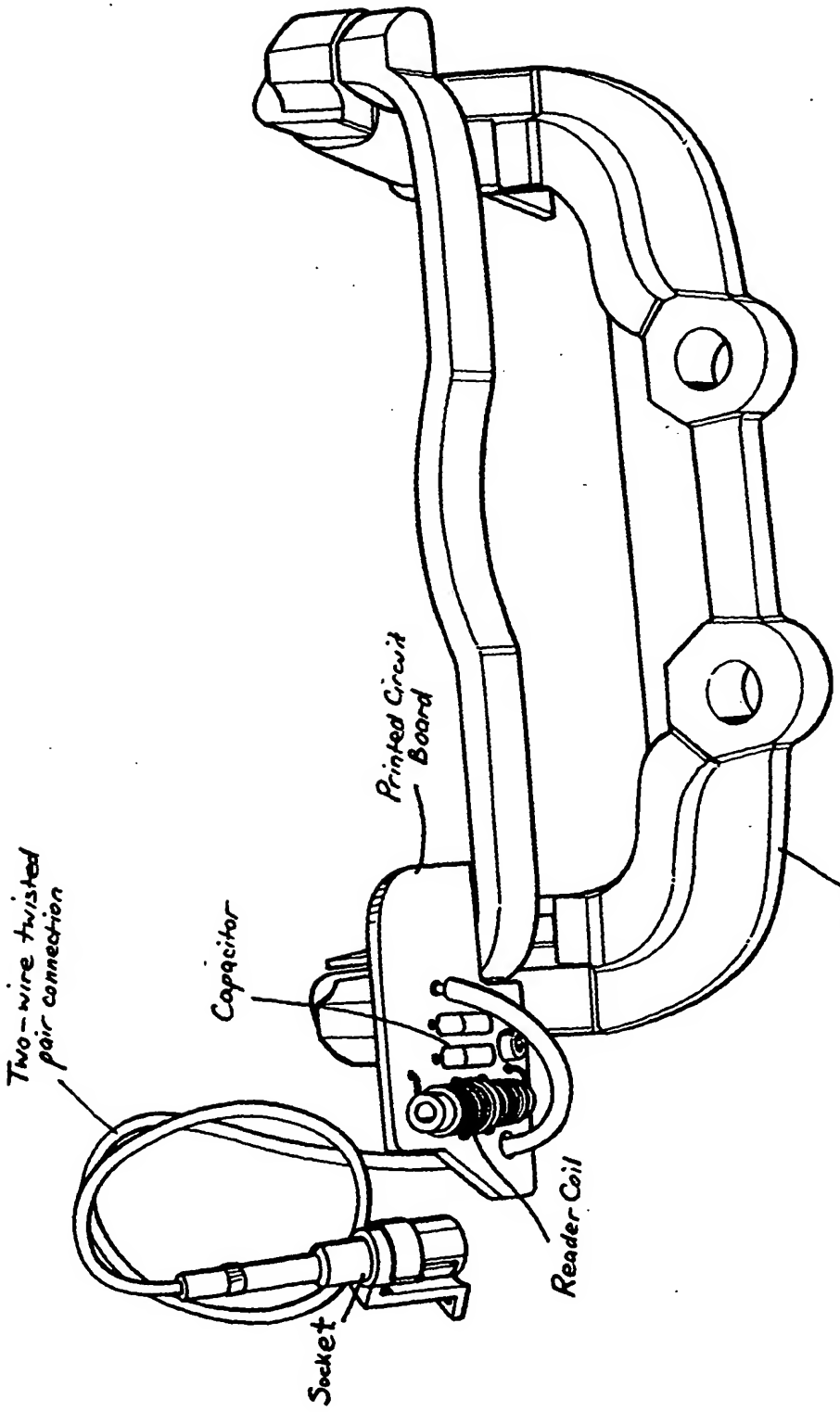

Two-wire twisted pair connection
Capacitor
Printed Circuit Board
Disk Brake Caliper Mounting Bracket
Reader Coil
Socket

FIG. 18

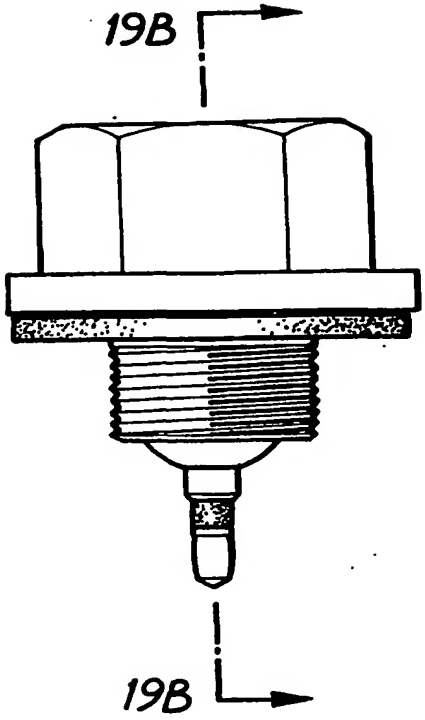


FIG. 19A

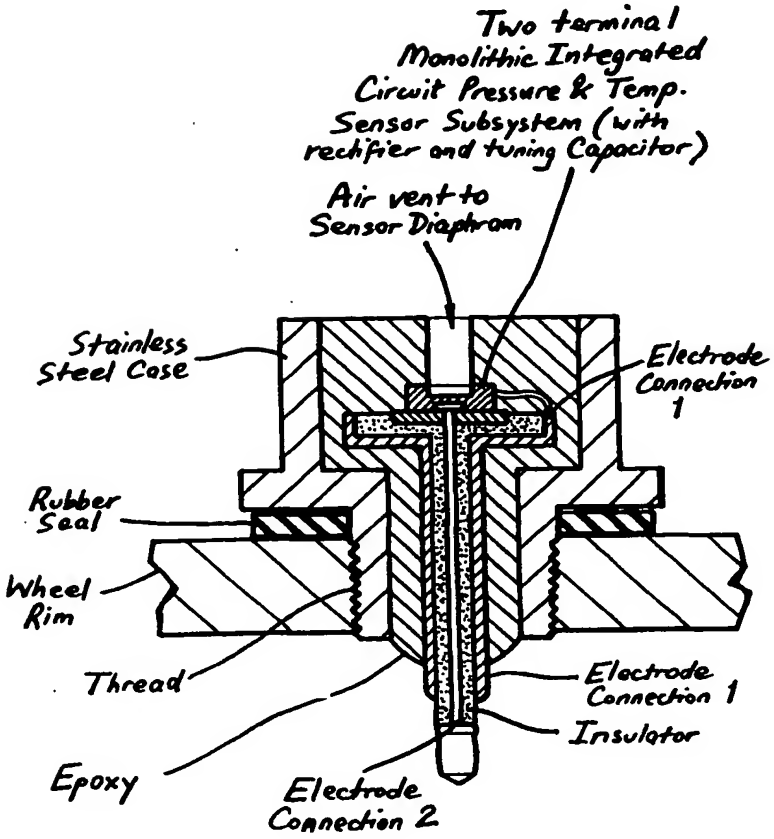


FIG. 19B

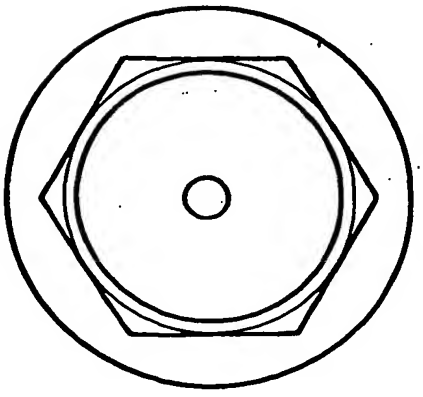


FIG. 19C

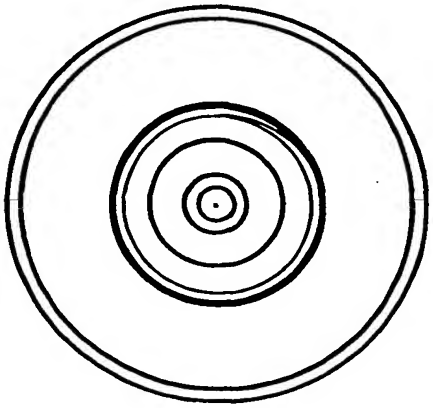


FIG. 19D